



Application No.: 09/839,759
Amendment and Response dated: April 28, 2003
Reply to Office Action of: January 30, 2003
Docket No.: 1085-2 RCE
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A. Amendments to the Claims:

The below listing of claims will replace all prior versions and listings of claims in the subject application.

Claim 1. (Currently Amended) A process for recovering ethane from a hydrocarbon gas stream having methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 % by mole propane;

cooling the hydrocarbon gas stream by refrigeration to form a cooled and substantially condensed hydrocarbon feed gas stream, ~~wherein said cooling of said hydrocarbon gas stream by refrigeration does not include turbo-expansion of said hydrocarbon gas stream;~~

separating the cooled and substantially condensed hydrocarbon feed gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

separating said ethane/propane-rich stream into an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

Claim 2. (Original) The process of claim 1 wherein said expanding of said methane-rich stream further includes:

turboexpanding said methane-rich stream.

Claim 3. (Original) The process of claim 1 wherein said expanding of said methane-rich stream further includes:

compressing said methane-rich stream into a compressed methane-rich stream;
cooling said compressed methane-rich stream; and
turboexpanding the cooled and compressed methane-rich stream.

Claim 4. (Currently Amended) The process of claim 1 wherein separating said cooled and substantially condensed hydrocarbon feed-gas stream further includes:

distilling said cooled and substantially condensed hydrocarbon feed gas stream in a demethanizer column.

Claim 5. (Original) The process of claim 1 wherein separating said ethane/propane-rich stream further includes:

distilling said ethane/propane-rich stream in a de-ethanizer column.

Claim 6. (Canceled)

Claim 7. (Canceled)

Claim 8. (Original) The process of claim 1 wherein said ethane-rich stream contains at least 90 % by mole ethane.

Claim 9. (Original) The process of claim 1 wherein said ethane-rich stream contains at least 96.5 % by mole ethane.

Claim 10. (Original) The process of claim 9 wherein said ethane-rich stream contains less than about 0.5 % by mole methane and less than about 3% by mole propane.

Claim 11. (Original) The process of claim 1 wherein said methane-rich stream contains at least 95% by mole methane.

Claim 12. (Currently Amended) A process for recovering ethane from a methane, ethane and propane containing gas stream comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 % by mole propane;

cooling the hydrocarbon gas stream to provide a vapor hydrocarbon feed stream and a condensed liquid hydrocarbon feed stream;

cooling the vapor hydrocarbon gas feed stream in a cryogenic heat exchanger by heat exchange with a first cooling source, a second cooling source and a third cooling source to form a cooled and substantially condensed hydrocarbon feed gas stream, wherein said first cooling is said condensed liquid hydrocarbon feed stream ~~of said hydrocarbon gas stream does not include turbo expansion of said hydrocarbon gas stream;~~

distilling the cooled and substantially condensed hydrocarbon feed gas stream and the condensed liquid hydrocarbon feed stream in a demethanizer column to form a methane-rich stream and an ethane/propane-rich stream, wherein methane-rich stream is said second cooling source;

compressing said methane-rich stream to form a compressed methane-rich stream;

cooling said compressed methane-rich stream to form a compressed methane-rich stream;

turboexpanding said compressed methane-rich stream to a lower pressure to provide a said third cooling source for said cryogenic heat exchanger;

distilling said ethane/propane-rich stream in a de-ethanizer column to form an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

Claim 13. (Original) The process of claim 12 wherein said ethane-rich stream contains at least 96.5 % by mole ethane.

Claim 14. (Currently Amended) A process for providing a methane-rich stream from a hydrocarbon stream containing methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40 50 % to about 80 75 % by mole methane, from about 10 15 % to about 50 40 % by mole ethane and from about 0.5 1 % to about 10 4 by mole propane;

cooling the hydrocarbon gas stream by refrigeration to form a cooled and substantially condensed hydrocarbon feed gas stream, ~~wherein said cooling of said hydrocarbon gas stream by refrigeration does not include turbo expansion of said hydrocarbon gas stream;~~

separating the cooled and substantially condensed hydrocarbon feed gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

recovering said methane-rich stream.

Claim 15. (Original) The process of claim 14 wherein said methane-rich stream contains at least 95 % by mole methane.